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Attitude and Strategies for Small Farmers in Facing Farm Risks: Case Study of Large Chili Farming in Lombok Island, Indonesia

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This paper describes the types of risks, sources of risks, levels of risks, attitudes, and strategies of small farmers in dealing with the risks of large chili farming businesses on Lombok Island, Indonesia. Data collection used the triangulation method, a combination of structured interview methods with farmers, in-depth interviews with key informants, field observations, virtual surveys, and literature studies. Types of risks were analyzed descriptively; sources of risks were analyzed using FMEA; risk levels using the coefficient of variation; farmers' attitudes towards risk using regression and farmers' strategies in dealing with risks were analyzed descriptively, qualitatively and quantitatively. The study found that the types of farming risks faced by farmers are production risks and product price risks. The main sources of production risk are pest and disease attacks and climate change, while price risks come from the abundance of chili production. In dealing with production risks, farmers take a risk-taking attitude, while in dealing with price risks, farmers are neutral. One of the effective risk management strategies that supports the sustainability of large chili farming businesses on Lombok Island is cooperation between farmers and collectors and/or inter-island traders, this is what makes this study new because it is unique and has not been found in other farming businesses.

Keywords: Coefficient variation, triangulation methods, large chili farm, Lombok Island, risk management.

INTRODUCTION

Risk in farming is a global issue influenced by various factors, including climate change, pest and disease attack, market price fluctuations, and often unstable agricultural policies. Climate change leads to unpredictable weather patterns, such as floods and droughts, which impact agricultural productivity worldwide. Additionally, the volatility of agricultural commodity prices in international markets can disrupt the sustainability of farming businesses, particularly in developing countries whose economies heavily rely on agricultural output. Other risks include limited access to modern agricultural technology, insufficient capital, and dependence on external inputs such as fertilizers and pesticides, which further increase farmers' vulnerability to economic and environmental shocks. Therefore, sustainable risk mitigation strategies—such as business diversification, the use of environmentally friendly technologies, and protective policies for farmers are very important in dealing with risks and uncertainties in the agricultural sector globally. One of Indonesia's agricultural commodities that faces numerous farming risks yet remains widely cultivated and is a mainstay commodity of the horticulture sub-sector is chili. This commodity can be grown on various types of land, is not restricted by planting seasons, can be sold either fresh or processed, and holds significant socio-economic value. Chili is also a food ingredient that is consumed at any time and cannot be substituted, so chili will continue to be needed in increasing quantities along with population growth, the national economy and the development of the national food industry (Anonymous, 2020). However, chili farming in Indonesia has several characteristics that make it a capital and labor-intensive, high-risk commodity. It requires open land and specific climate conditions for optimal growth, leading to relatively high input and production costs compared to other, that are easier to plant and maintain. Additionally, chili also requires a relatively large and trained workforce to cultivate the land, plant and maintain plants (Salim, 2013; Anonymous, 2021). Chili is also considered a high-risk commodity, and its development is closely monitored by the government due to its significant impact on inflation, which is 0.18%, the highest of the agricultural commodity group (Badan Pusat Statistik,

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2023). This is primarily due to sharp price fluctuations-in the dry season the price drops drastically because production is abundant, whereas in the rainy season the price increases sharply, because production drops drastically (Zaini, 2012; Zaini *et al.*, 2021).There are many types of farming risks faced by farmers, the five most important of which are production risk, market risk, institutional risk, personal risk and financial risk (Komarek *et al.*, 2020; Ullah *et al.*, 2016). The existence of various risks and uncertainties affects farmers in making investment decisions in farming activities. There are three possible attitudes of farmers as decision makers in farming activities, namely: (1) decision makers who are afraid of risk (risk aversion); (2) decision makers who are brave towards risk (risk taker), and (3) decision makers who are neutral towards risk (risk neutral) (Robinson and Barry, 1987). Theoretically, farmers' attitudes in making these decisions have an impact on agricultural productivity and farm income (Ellis, 1988). For farmers who behave fearfully towards risk, the utilization of resources (land, labor and other means of production) is not carried out optimally, resulting in lower productivity and farm income than can be produced. But for farmers who are brave in taking risks (risk takers), then the utilization of resources will be carried out optimally to obtain maximum productivity and income, even with the possibility of a greater risk of loss. Meanwhile, for farmers who are neutral to risk, the utilization of resources is not affected by the existence of risk. Farmers' courage and strategies in facing risks are influenced by farmers' perceptions of the types and sources of risk, their attitudes toward risks; characteristics of the farm and household, and farmers' access to publicly provided services including agricultural credit and information(Ullah *et al.*, 2016; Asravor, 2019; Ahmad *et al.*, 2019). Small farmers are generally afraid of risks because failure in their farming activities will threaten the economic life of household members (Robinson and Barry, 1987). This is reinforced by the results of studies in Pakistan (Ahmad *et al.*, 2019), Turkey (Binici *et al.*, 2003), Nigeria (Tigre and Heshmati, 2023) and several research results in Indonesia, such as research on swamp ecosystems in Ciamis Regency (Yusuf, 2024), vegetable farming in the District Pangalengan, Bandung District (Fariyanti *et al.*, 2007), rice fields and dry land in North Lombok Regency (Sjah *et al.*, 2023). However, research on virginia tobacco farming on Lombok Island (Siddik *et al.*, 2015), small chili, large chili, and curly chili farming in the chili center area of Lombok Island (Siddik *et al.*, 2022) shows that farmers are brave in facing production risks and neutral in facing price risks.

In Indonesia, most farming households are small farmers with limited land ownership (less than 0.5 hectares) (Badan Pusat Statistik, 2023). On Lombok Island, West Nusa Tenggara Province, 72.45 percent of farming households are small farmers with an average land ownership area of 0.42 hectares, consisting of 0.24 hectares of rice fields and 0.18 hectares of dry land. One type of agricultural commodity that is widely cultivated by farmers on Lombok Island is large chilies. This study aims to analyze the types of risks, sources of risks, levels of risks, attitudes and strategies of small farmers in dealing with large chili farming risks on Lombok Island, Indonesia.

MATERIALS AND METHODS

This research uses survey method (Babbie, 2004), that aims at collecting data as it is in the field. The research was conducted on Lombok Island, West Nusa Tenggara Province. The location of the research was determined in stages (*multistage sampling)* starting from the district/city level, sub-district to village level and farmer groups based on the height of the place above sea level and the center of large chili production in each area. On this basis, Sembalun Village, Sembalun District was selected to represent the highland area (>500 meter above sea level), Pengadangan Village, Pringgasela District represents the medium plain area (300-500 meter above sea level), and Kalijaga Village, Aikmel District represents the lowland area (<300 meter above sea level). Furthermore, from the sample villages, farmer groups were selected who cultivated large chilies throughout the year.

The farmers who were the objects of the study were farmers who were members of farmer groups who controlled narrow land (less than 0.5 ha) and cultivated large chilies in the rainy season and dry season respectively in the 2023 planting season. The number of respondents was set at 45 people, selected by simple random sampling from members of farmer groups in each sample area or village (15 people in each area). Data collection used the triangulation method (Flick, 2018), i.e. combining structured interview methods with respondents, in-depth interviews with key informants (Head of Farmer Groups, Agricultural Extension Workers, Collectors, and Inter-Island Traders), field observations, virtual surveys and literature studies. Each method has its own interests and is integrated with each other. Structured interviews using a list of questions aim to determine the type, source, level, attitude and strategy of each farmer in dealing with each type of farming risk. In-depth interviews aim to clarify unclear information from respondent farmers and general information related to the research. Field observations aim to determine the real conditions of farming communities and large chili farming in each research location. Virtual surveys aim to trace and find the latest research results contained in scientific journals related to farming risks and strategies in overcoming these farming risks. Literature studies are primarily intended to find theories that discuss farming risks and farming risk management.

Types of farming risks are analyzed descriptively based on literature reviews and data variations on variables that determine farm income, i.e. production volume, product

prices, and production costs between planting seasons. Furthermore, determining the main source of causes of farming risks, based on farmer perceptions, is analyzed by using the *FMEA (Failure Mode Effect Analysis) method* (NCPS, 2015; El-Awady, 2023). The assessment criteria consist of: (1) Risk Severity Impact Value (S); (2) Risk Opportunity Value (O), and (3) Risk Detection Value (D). All risk sources are assessed following a Likert scale from 1-5 as describe in Table 1.

Table 1. Impact, opportunity, and detection of risk in large chili farming in Lombok Island (2023).

1)	**Severity Impact of Risk (S)**	
Scale	**Impact Level**	**Information**
1	Very Low	Negative impact <5 percent
2	Low	Impact 6 -20 percent
3	Currently	Negative impact 21-35 percent
4	Tall	Negative impact 36-50 percent
5	Very high	Negative impact >50 percent
2)	**Occurance Opportunity of Risk (O)**	
Scale	**Opportunity Level**	**Information**
1	Very Low	Once in > 4 years
2	Low	Once in 3 years
3	Currently	Once in 2 years
4	Tall	Once a year (2 planting seasons)
5	Very high	Every planting season
3)	**Detection Anticipation of Risk (D)**	
Scale	**Detection Level**	**Information**
1	Very Low	Can be anticipated > 90 percent
2	Low	Can be anticipated 71-90 Percent
3	Currently	Can be anticipated 51-70 percent
4	Tall	Can be anticipated 31-50 percent
5	Very high	Can be anticipated 31-50 percent

Furthermore, to determine the priority level of risk sources based on *the Risk Priority Number (RPN)* value with the following formula (Stematis, 2003):

$RPN = S \times O \times D$

Where;
S = Severity impact value
O = Occurance opportunity value
D = Detection anticipation value

The greater the severity of the impact caused, the more frequent the chance of occurrence and the more difficult the risk source is to detect, the more detrimental the risk source is. This means that the priority level of the risk source is higher or more prioritized to be anticipated and overcome. Like the risk of farming caused by viruses, the priority level is higher when compared to the risk source caused by fungi, because in addition to the greater severity of the impact caused. it is also more difficult to detect.

The level of farming risk is measured using the coefficient of variation derived from the variance and standard deviation based on the farmer's experience in carrying out previous large chili farming activities. To measure risk, such as production risk and price risk, use the following variance formula :

$Eq_i = q_{ih}Q_{ih} + q_{ir}Q_{ir} + q_{in}Q_{in}$
$Vq_i = q_{ih}\,[Q_{ih} - Q_i]^2 + q_{ir}[Q_{ir} - Q_i]^2 + q_{in}[Q_{in} - Q_i]^2$
$Ep_i = q_{ih}P_{ih} + q_{ir}P_{ir} + q_{in}P_{in}$
$Vp_i = q_{ih}[P_{ih} - P_i]^2 + q_{ir}[P_{ir} - P_i]^2 + q_{in}[P_{in} - P_i]^2$

Where; Q = Production (Kg/Ha)
Eqi = Production expectations (Kg/Ha)
Vq_i = Chili production variants
P = Chili price (IDR/Kg)
Ep_i = Expected price of chili (IDR/Kg)
Vp_i = Chili price variants
I = Sample or respondent i
q = Production opportunities or chili price opportunities
h,r,n = Shows high (h), normal (r) & low (n) production or price opportunities

Furthermore, to measure the level of farming risk faced by farmers, the coefficient of variation (CV) is used, with the following formula:

$CV_{qj} = \frac{SDqj}{\overline{Qj}}$
$CVpj = \frac{SDpj}{\overline{Pj}}$

Where; CVqj = Coefficient of variation of chili production
SDq_j = The standard deviation of chili production
CVpj = Coefficient of variation of chili prices
SDp_j = The standard deviation of chili prices

In addition to using the coefficient of variation, the level of production and price risk faced by farmers can be measured with quantitative figures, namely by measuring the lower limit value of the highest production results (Lq) and the lower limit value of the highest price results (Lp), with the following formula:

Lq = Qq – 2SDqj
Lp = Pp – 2 SDpj

The coefficient of variation (CV) and the lower limit of the highest return (L) indicate whether the invested capital is safe from possible losses. If the CV value <0.5 or the L value >0, then the risk level is low. This means that the risk faced does not cause losses. Conversely, if the CV value >0.5 then the L value < 0, then the risk level is high. This means that the risk faced is detrimental (Hernanto, 1993).

To analyze the attitude of farmers in facing farming risks using the basic model proposed by Beach *et al.* (2005, 2008) and Ellis (1988). The willingness of farmers to take risks can be seen from the courage of farmers to invest in farming activities, such as in using land (Li), using labor and in using other important inputs (Xij). Therefore, to analyze the behavior of farmers in facing farming risks, a regression model can be used by placing the use of production inputs as

the dependent variable and production risk and price risk measured by the coefficient of variation as independent variables along with other variables that are thought to influence the use of these production inputs, such as production expectations, price expectations, land rent, labor costs, real prices of large chilies in the previous season and dummy variables for the planting season. The regression equation used is the following multiple linear model:

$$Li = a_0 + a_1 Eq_i + a_2 CVq_i + a_3 Ep_i + a_4 CVp_i + a_5 S_{Li} + a_6 W_{Ti} + a_7 P_{qi} + a_8 D_i + E_{1i}$$

$$Ti = b_0 + b_1 Eq_i + b_2 CVq_i + b_3 Ep_i + b_4 CVp_i + b_5 S_{Li} + b_6 W_{Ti} + b_7 P_{qi} + b_8 D_i + E_{2i}$$

$$Xji = c_0 + c_1 Eq_i + c_2 CVq_i + c_3 Ep_i + c_4 CVp_i + c_5 S_{Li} + c_6 W_{Ti} + c_7 P_{qi} + c_8 D_i + E_{3i}$$

Where; L_i = land area (Are)

T_i = Total labor usage (HKO)

X_{Ji} = Other important production inputs include seeds, phonska fertilizer, organic fertilizer, medicines, mulch, and stakes

S_{Li} = Land rental value (IDR. /Are)

W_{Ti} = Labor wages (IDR/HKO)

P_{qi} = Large chili price (IDR/Kg)

D_i = Planting season (rainy season=0; dry season=1)

E_i = Error term (disruption)

If the production risk (CVq_i) or price risk (CVp_i) has a positive and significant effect on a minimum confidence level of 85% in using production inputs (L_i, T_i, X_{ji}), then the farmer is concluded to behave bravely towards risk (*risk taker*); and if it has a negative and significant effect, then the farmer behaves afraid of farming risks (*risk aversion*). However, if it does not have a significant effect on the level of confidence, then the farmer is considered to behave neutrally towards risk *(risk-neutral).*

Household strategies in dealing with farming risks are analyzed descriptively qualitatively and quantitatively, including:

1. Ex-ante strategy or anticipation strategy, which is a strategy carried out by farmers before a shock or production process occurs. This strategy is designed to prepare farming so that it is not in a position that is too vulnerable when the shock occurs.
2. Interactive strategies are strategies that farmers carry out when shocks occur, which involve reallocating resources so that the impact of risk on production can be minimized, and
3. Ex-post strategy is a strategy carried out by farmers after a shock occurs, which is aimed at minimizing subsequent impacts.

RESULTS

***Types of farming risks*:** There are many possible types of farming risks faced by farmers, the five most important of which are production risk, market risk, institutional risk, personal risk, and financial risk (Ullah *et al.*, 2016; Komarek *et al.*, 2020). Determination of the types of farming risks faced by large chili farmers on Lombok Island is based on variations in the values of variables that determine farm income, including production, price, and production costs. The greater the variation or difference in the values of these variables between the rainy season and the dry season, the greater the risk is faced.

Table 2 shows that the variation in farm income in the rainy season and dry season is largely due to production variation and price variation, while production costs do not vary much between the rainy season and the dry season. In the rainy season, the average production produced by farmers is 11,433 kg/ha, much lower than the dry season of 17,198 kg/ha. On the other hand, the price received by farmers in the rainy season is much higher, which is an average of IDR 22,498/kg, while in the dry season it is IDR 12,498/kg. Meanwhile, the farming costs incurred do not show a striking difference, which is IDR 101 million in the rainy season and IDR 105 million in the dry season per hectare. This means that the variation in income obtained by large chili farmers on Lombok Island is caused by production risk and product price risk.

Table 2. Variation in production, price, cost and income of large chili farming per hectare on Lombok Island (2023).

No.	Description	Rainy season	Dry season
1.	Production (Kg/Ha)	11,433	17,198
2.	Price (IDR/Kg)	22,498	12,683
3.	Production Value (IDR.000)	261,223	223,203
4.	Production Cost (IDR.000)	100,708	105,299
5.	Farm Business Income (IDR.000)	160,516	117,905

This risk in large chili farming is also the same as that faced in other farming businesses, such as in virginia tobacco farming (Siddik *et al.*, 2015) cayenne pepper and curly chili farming (Siddik *et al.*, 2022); potato and cabbage farming (Fariyanti *et al.*, 2007). Likewise in wheat, sugar beet, corn, and barley farming found by El Benni and Finger (2014), where variations in farmers' net income are more due to variations in production and product prices than productn costs.

***Sources of risk in large chili farming*:** Based on the results of the literature review, virtual surveys, and interviews with key informants, it was found that there were 20 possible sources of risk for large chili farming businesses on Lombok Island. After being studied and analyzed using FMEA and ranked, 10 main sources of risk for large chili farming businesses were found on Lombok Island. Of the 10 sources

of risk, 8 sources lead to the type of production risk; and two sources lead to the type of product price risk (Table 3). Sources of risk that lead to the type of financial risk, personal risk, institutional risk, or policy were not perceived by farmers as the main source of risk for large chili farming businesses. There are four most prominent sources of production risk, namely: fruit rot, fruit flies, root rot, and high rainfall. Other important sources of production risk are the hot sun and lack of water, caterpillar pests, aphids, and strong winds. The two main sources of price risk are the abundant production of large chilies on Lombok Island (ranking 5) and/or from outside Lombok Island (ranking 9). Both sources of risk are perceived as the cause of the decline in the price of large chilies on Lombok Island.

Over production usually occurs during the dry season, which is mostly produced by "beginner chili farmers" who do not continuously cultivate large chilies, and they generally do not have regular customers as buyers. Meanwhile, "genuine chili farmers" who continuously cultivate large chilies, generally already have "regular customers or buyers" who are ready to buy farmers' chilies at the prevailing market price at that time. Often from buyers or collectors, farmers obtain capital to cultivate chilies every planting season. However, there was no binding cooperation model that determined prices before the harvest. Loan assistance only morally binds farmers to sell their produce to the relevant collectors when the harvest arrives at the price prevailing at that time.

Collectors who buy farmers' chilies generally sell to large collectors on Lombok Island and/or to inter-island collectors. Therefore, if chili production outside is abundant, the price of chilies on Lombok Island will immediately drop drastically. This is what farmers fear because it cannot be controlled and predicted.

In contrast to the sources of production risks, although very diverse and mostly come from nature to a certain extent they can still be anticipated and controlled by farmers. Farmers in areas with large chili production centers, on average, have experience in large chili production activities, and the technology for cultivating large chilies has mostly been mastered by farmers; so that losses resulting from these sources of risk can be minimized. Only a few aspects seem to be lacking, such as pest and disease control as the main source of production risk is still carried out individually, making it difficult to overcome completely. Pest and disease control should be controlled in an integrated and collaborative manner, because it is almost impossible for pests and diseases such as fruit flies to be controlled individually by farmers.

***Risk level of large chili farming*:** Risk measurement and risk level using the coefficient of variation derived from variance and standard deviation (Anderson *et al.*, 1977; Huirne *et al.*, 2000: Tajidan *et al.*, 2022; Siddik, 2023). The results of the analysis show that the risk of large chili farming in Lombok Island is still relatively low, both in terms of production risk and price risk; both in the rainy season and in the dry season, where the coefficient of variation (CV) is less than 0.5 and and the lower limit of the highest result (L) is greater than 0. However, when compared between the two types of risks, the price risk faced by farmers is higher than the production risk (Table 4).

Table 3. Ranking of risk sources for large chili farming on Lombok Island (2023).

No.	Impact of Risk	Risk Opportunity	Risk Detection	Risk Weight	Ranking of Risk	Ranking of Risk
1.	Fruit Rot	158	121	134	1,299	1
2.	Fruit Fly	159	161	105	1,289	2
3.	Root Rot	142	142	136	1,236	3
4.	Heavy Rainfall	156	111	146	1,221	4
5.	Abundant Production	121	135	108	871	5
6.	Hot and Waterless	126	106	115	845	6
7.	Caterpillar Pests	115	130	112	844	7
8.	Aphid Pests	116	122	113	803	8
9.	Overseas Products Abundant	122	117	92	746	9
10.	Strong winds	150	71	145	706	10
11.	Birds/Animals/Humans	100	128	83	556	11
12.	Many Competing Plants	101	93	107	523	12
13.	Low Quality	93	109	96	475	13
14.	Expensive Cost	108	79	84	395	14
15.	Lack of Technology	103	81	74	318	15
16.	Lack of Capital	96	75	72	316	16
17.	Scarce Labor	98	81	70	287	17
18.	Long Market Chain	94	69	85	267	18
19.	Not Business Oriented	96	71	68	241	19
20.	No/Lack of Extension Workers	105	68	66	239	20

Table 4. Production risk and price risk of large chili farming on Lombok Island (2023).

No.	Description	Rainy Season	Dry Season
1.	Production risk		
	Production variance	26,605,525	34,285,424
	Standard deviation of production	5,075	5,684
	Coefficient of production variation (CVq)	0.42	0.34
	Lower limit of highest yield (Kg/Ha)	1,923	5,511
2.	Price risk		
	Price variance	187,987,755	38,992,660
	Standard deviation of price	13,623	6,180
	Coefficient of price variation (CVp)	0.46	0.47
	Lower limit of highest yield (IDR/Kg)	2,333	861

The results of this study differ from the results of previous studies conducted in chili production centers dominated by small chilies (Siddik *et al.*, 2022). The risk of large chili production in the area is relatively high with a coefficient variation of 0.51. There are two possibilities for this to happen, namely first that the land for small chili production centers on Lombok Island is less suitable for large chili cultivation because the results of the study show that the higher an area is above sea level, the higher the production of large chilies; conversely, the production of cayenne pepper is lower; and/or second, the ability of farmers to manage farming risks in the area also seems to be lower than in large chili production centers.

Meanwhile, in terms of price risk, it is relatively the same between large chili production centers and small chili production centers; because prices are not determined by the place of business, but rather by market mechanisms. Therefore, farmers tend to speculate rather than consider the risks they face when facing price risks.

***Farmers' attitude toward risks*:** Attitude of farmers in facing farming risks is analyzed by using multiple linear regression models. The farming risks in question are production risk (CVq) and price risk (CVp) which are measured by the value of the variance coefficient, then analyzed its influence on farmer behavior in deciding the use of important production inputs, such as the area of farming land (L), use of labor (T), use of seeds (X_1), use of phonska fertilizer (X_2), use of drugs (X_3) and use of plastic mulch (X_4). Together with farming risks, the influence of Production expectations (Eq), price expectations (Ep), land rent (S_L), labor costs (W_T), and the price of large chili products (Pq) are also analyzed.

The results of the analysis show that in general production risk and price risk together with other independent variables (F-test) affect the attitude or courage of farmers in using the above production inputs. Partially (t-test), production risk consistently has a positive and significant effect ($\alpha < 15\%$) on the use of land, labor, seeds, medicines, and plastic mulch production inputs. While price risk does not have a significant effect ($\alpha > 15\%$), only the use of seeds has a positive and significant effect (Table 5).

The results of the study indicate that large chili farmers on Lombok Island are brave in facing production risks. They are risk takers. This means that to obtain greater income or to face possible losses as a result of production risks, farmers are willing to spend more money to rent land and buy the

Table 5. Estimation results of farmers' attitude toward risks of large chili farm on Lombok Island, 2023.

No.	Independent Variable	Dependent Variable					
		Land (L)	Labor (T)	Seeds (X_1)	Phoska (X_2)	Pesticide(X_3)	Mulch (X_4)
0.	Constant	7,964	-16,320	816,209	76,382	-9,784,591	4,322
1.	Expected Production (E_{Qj})	0.006[1)]	0.029 [1)]	1,488[1)]	0.017[1)]	0.197[1)]	0.008[2)]
2.	Expected Price (E_{Pi})	0,000	(0.002)	(0.257)[3)]	(0.007)[2)]	(0.005)	0,000[2)]
3.	Production Risk (CV_{Qj})	1,083-06[3)]	7,911-06[2)]	0.001[1)]	7,191-07	0,000[1)]	6,159-06[2)]
4.	Price Risk (CV_{Pi})	1,889-08	1,240-7	1,879-05[2)]	2,006-07	1,710-06	(4,440-09)
5.	Land Rent (S_{Li})	(4,015-05)[1)]	0,000[2)]	0.003	0,000[3)]	(0.002) [1)]	(9,802-05)[2)]
6.	Labor Costs (W_{Ti})	5,733-05	(0.001)[1)]	0.10	0,000	0.004	0.001[1)]
7.	Large Chili Price (P_{Qi})	0,000	0.008[1)]	0.162[4)]	0.008[1)]	0.042[2)]	(0.001)
8.	Planting Season (Di)	(6,551)[2]	50001[1)]	-1,119,188	-12,523	23,650	-20,002
	F-Test	70617[1)]	100112[1)]	68945[1)]	8592[1)]	43245[1)]	12,877
	Determination Coef. (%)	87.50	90.80	87.20	45.90	81.00	56.00
	Durbin Watson Stats.	1,437	1,470	1,151	1,747	2,348	1,244

Information:
1) Significant at alpha 1% 3) Significant at alpha 10% 2) Significant at alpha 5% 4) Significant at alpha 15%

necessary production inputs, even though this could result in greater losses. However, with sufficient farming experience and adequate mastery of cultivation technology, farmers rarely experience losses as a result of production risks.

Meanwhile, in facing price risk, farmers tend to be neutral, which is indicated by the insignificant effect of price risk on the use of these production inputs. This means that farmers tend not to be affected in making farming decisions by changes in price. This is understandable, because prices are determined by market mechanisms, beyond the knowledge and reach of farmers. The abundance of large chili production on Lombok Island and/or outside Lombok Island is realized

Table 6. Strategies of large chili farmers in dealing with farming risks (2023).

No.	Description	Rainy season		Dry season	
		Person	%	Person	%
A.	**Strategy Before Production Process or Shock (*Ex-ante Strategy*)**				
1.	Make appropriate planting time plans to anticipate uncertain climate developments.	15	33	15	33
2.	Choose plant varieties that suit the seasonal conditions and the surrounding environment.	45	100	25	56
3.	Clearing land from agricultural waste which is a source of pests and diseases	45	100	45	100
4.	Cutting/pruning stems/branches of plants that block sunlight	45	100	45	100
5.	Cultivate the land and arrange the direction of the planting beds and drainage channels to ensure smooth drainage of excess water.	45	100	45	100
6.	Provide sufficient basic fertilizer (dolomite, organic fertilizer/manure, etc.) that is free from pests and diseases.	45	100	45	100
7.	Install plastic mulch to maintain soil moisture & inhibit the growth of weeds.	45	100	45	100
8.	Prepare sufficient business capital to finance all farming activities	15	33	15	33
9.	Planning to plant crops other than large chilies on the same or different land	26	58	30	67
10.	Cooperating with collectors or inter-island traders	40	89	40	89
11.	Have sources of income other than farming activities	45	100	45	100
	Amount A	411	83	270	55
B.	**Strategy During Production Process/Events Occur (*Interactive Strategy)***				
1.	Arrange the planting distance sufficiently to make maintenance and sunlight easier.	45	100	45	100
2.	Using complete fertilizer, starting from basic fertilizer to additional fertilizer according to location needs.	38	84	38	84
3.	Carry out regular pest and disease control to anticipate pest and disease attacks.	45	100	45	100
4.	Carrying out integrated pest and disease control together with members of the farming group or farmers in the area	8	18	8	18
5.	Weeding plants from weeds	45	100	45	100
6.	Clean up unproductive young shoots that interfere with plant growth.	45	100	40	89
7.	Clean the base of the plant from old leaves that can become nests for pests and diseases.	45	100	40	89
8.	Remove and clean plants that are attacked or die due to pests and diseases.	45	100	40	89
9.	Provide stakes and tie each plant so that it does not fall over due to strong winds and/or heavy rain before the incident occurs.	41	91	38	84
10.	Clean irrigation and drainage channels regularly during the production process.	41	91	38	84
11.	Carry out harvesting activities regularly, on time and in the right way.	40	89	40	89
12.	Transporting and storing chili harvests in the right containers	40	89	40	89
	Amount B	478	89	344	64
C.	**Strategy after the production process/event occurs (*Ex-post Strategy)***				
1.	Identify problems or deficiencies that occur before and during the production process/event occurs	12	27	12	27
2.	Clearing the land of crop residue, all waste, and tree branches that interfere with subsequent farming efforts.	45	100	45	100
3.	Leaving plants bare (empty) for more than 7 days	42	93	38	84
4.	Providing drying infrastructure and facilities to anticipate overproduction	15	33	15	33
5.	Planning to replace the type of plant from a different family with chili to break the attack of the same pests and diseases	10	22	0	0
	Amount C	124	23	110	20
	The sum of A + B + C	1013	70	724	50

by farmers that it will directly affect the decline in the price of large chilies on Lombok Island, but this is realized after the harvest season arrives which cannot be predicted by farmers before they start planting. Therefore, they tend to be neutral in facing price risk and act as price takers as is the case in a perfectly competitive market.

Table 5 also shows that in addition to production risk, other factors that consistently and positively influence the use of production input are production expectations (Eq) and chili prices (Pq). This means that the greater the expected production or price received by farmers, the more intensive and more use of important production inputs in large chili farming activities. Thus, production risk, production expectations, and the price of large chili products are determining factors for increasing large chili production which is carried out through increasing the use of production inputs.

***Farmer strategies in facing farming risks*:** All farmers carrying out large chili farming activities are aware that the farming activities carried out have various risks, especially production risks and price risks. To anticipate the emergence of these risks, farmers carry out various strategies, both before carrying out the production process, during the production process, and after the end of the production process (Table 6).

DISCUSSION

Farmers carrying out farming activities are assumed to aim to increase utility or welfare for their household members. To achieve this goal, farmers face various obstacles, both in the form of farming production constraints, labor constraints, and budget constraints (Beach *et al.*, 2005; Siddik, 2023; Singh *et al.*, 1986). In large chili farming activities on Lombok Island, the main production constraints faced by farmers in addition to the narrow area of farming land, which is an average of 0.22 hectares; also, the mastery of farming technology that is not yet optimal, which is indicated by the inability of farmers to balance chili production throughout the year. In the rainy season, the average production achieved by farmers was 11,433 kg/ha; while in the dry season, it reached 17,198 kg/ha.

In addition to the above constraints, chili farmers also face quite high farming risks, as indicated by the fluctuations in chili production and prices every year and every season. The price of large chilies on Lombok Island in the 2023 rainy season reached IDR 22,498/kg; while in the dry season, it was only IDR 12,683/kg. Farmers' behavior in facing farming risks affects the productivity and income of farming businesses as well as the economic welfare of farmer households (Ellis, 1988; Siddik, 2023; Zaini *et al.*, 2021).

Large chili farmers on Lombok Island are brave in facing production risks but tend to be neutral towards price risks (Table 5). The courage of large chili farmers in facing these production risks is different from the attitude of small farmers in general who are afraid of farming risks (Asravor, 2019; Tigre and Heshmati, 2023; Fariyanti *et al.*, 2007). This is very possible because the research location is a center for large chili production; where farmers on average have quite a long experience in cultivating large chilies (more than 10 years), and knowledge about cultivation and the production risks faced is quite adequate, so they are better able to manage farming risks, although they have not been able to balance production in the rainy season with the dry season.

In contrast to price risk, according to farmers' perceptions, the risk of large chili prices on Lombok Island comes from the abundant production of large chilies from within and/or outside Lombok Island, causing the price of chilies on Lombok Island to drop drastically. This is beyond the control and ability of farmers, so they are neutral and accept the prices prevailing in the market. Farmers' neutral attitudes and behavior towards price risk also occur in virginia tobacco commodities (Siddik *et al.*, 2015); small chili farming (Siddik *et al.*, 2022), and rice farming (Yusuf, 2024).

The source of agricultural production risk generally comes from unpredictable weather changes and pest and disease attacks (Girdžiūtė, 2012; Aryal *et al.*, 2021; Arbuckle *et al.*, 2015), Duong *et al.* 2019; Iqbal *et al.*, 2020). In large chili farming businesses on Lombok Island, production risks generally occur during the rainy season; originating from unpredictable weather changes, such as heavy rain accompanied by wind and storms; even though farmers have anticipated it by making drainage channels, using plastic mulch, using stakes; but because it often happens continuously; it is difficult to overcome properly. In addition, during the rainy season, farmers' crops are also attacked by many pests and diseases that cannot be controlled, because pest and disease control is still carried out individually, not in an integrated manner as it should be (Johnstone and Dpird, 2024; SHK *et al.*, 2023; Bourceret *et al.*, 2024).

Various risk management strategies are implemented by farmers in different countries. There are various risk management tools available to farmers to manage risk at the farm level. The implementation of risk management strategies is greatly influenced by farmers' risk perceptions, their attitudes towards risk, characteristics of the farm and farm household, and farmers' access to publicly provided services including agricultural credit and information (Ullah *et al.*, 2016; Asravor, 2019; Leitch, 2010; Van Winsen *et al.*, 2016). Diversification, credit reserves, and savings are often used in developing countries, while developed countries tend to rely on futures contracts, crop insurance, and hedge funds (Yu *et al.*, 2022). Diversification is the most widely used risk management strategy in both developed and developing countries (de Mey *et al.*, 2014; Biagini and Severini, 2022). Farmers in Ethiopia, India, Kenya, and Nepal respond to farm risks by changing farming practices, sustainable land management, reducing consumption, selling assets, using savings and loans, seeking alternative employment, and

assistance from the government or NGOs (Aryal *et al.*, 2021). In Indonesia, risk management is carried out in various ways, depending on the type of commodity and region; but most are carried out by diversifying products and income, choosing crop varieties and applying cultivation technologies according to the season, integrated pest and disease control, cooperation with agricultural cooperatives to overcome market and capital problems; and agricultural insurance (SHK *et al.*, 2023; Siddik *et al.*, 2021; Fattah *et al.*, 2023; Yanuartati *et al.*, 2023 ; Arimbawa *et al.*, 2024). The strategic policy for developing chilies in Indonesia is also implemented by using hybrid seeds, complete and balanced fertilization, improving irrigation infrastructure and farm roads, increasing the capacity of farmer resources, and expanding market targets and segments (Pusat Data dan Sistem Informasi Pertanian, 2020).

One of the risk management strategies found in large chili farming that has not been found in other places and commodities is cooperation between farmers and collectors or inter-island traders. The cooperation model is unique, non-binding, but is considered very effective in overcoming market problems, capital, information gaps and sustainability of farming, including social problems faced by farmers. On the basis of mutual assistance, mutual trust and mutual benefit, where farmers obtain market guarantees, capital loans, market information and cultivation technology; while traders obtain guarantees of goods according to the required criteria (such as fresh fruit, reddish green and stalked) so that they are durable in transportation, because on average chilies originating from production center areas are sold outside Lombok Island. To ensure the availability of goods, traders often provide capital loans to farmers so that they continue to cultivate chilies throughout the year and provide market information and technology that benefits both parties. Therefore, in the large chili production center areas of Lombok Island, on average farmers cultivate large chilies continuously throughout the year.

A similar cooperation model occurs in the Virginia tobacco farming business between farmers and tobacco companies or cigarette companies on Lombok Island. The cooperation pattern applied is the Agribusiness Operational Cooperation Pattern (KOA), where farmers provide land, facilities, and labor. While tobacco or cigarette companies provide capital, technology and market access. This pattern shows a fairly clear and mutually beneficial role and responsibility between farmers and their partners. Although the role of each party is quite clear, and under the supervision of the government or the Plantation Service; however, from the results of Hamidi's (2010) found many deviations carried out by each party, mutual suspicion so that many farmers did not continue their cooperation, either because they were expelled or stopped on their own.

The advantages of cooperation between large chili farmers and collectors and inter-island traders above are not formally binding, but morally binding and there is closeness between farmers and traders. However, the limitations of this study are the location of the study which is limited to areas that are centers of large chili production in the highlands, medium plains and lowlands; and the number of respondents and research time are limited. Therefore, the results of this study have not been able to conclude the conditions of large chili farmers in general.

***Conclusion*:** The types of farming risks faced by large chili farmers on Lombok Island are production risk and product price risk with a relatively low-risk level; however, the price risk is higher than the production risk. The main source of production risk comes from attacks by pests such as fruit rot, fruit flies, root rot, and heavy winds and rainfall. The main source of price risk comes from the abundance of large chili production inside and/or outside Lombok Island. The attitude of large chili farmers in facing production risks is included in the brave category (risk *taker)*, while in facing price risks they behave neutrally (risk-*neutral*). The risk management strategy that supports sustainable large chili farming on Lombok Island is cooperation between farmers and collectors and/or inter-island traders. The previous statemant is the novelty of this research.

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